

(11) (A) No. 1081940

(45) ISSUED 800722

(52) CLASS 32-B3  
C.R. CL. 198-17(53) INT. CL. B66C 1/42<sup>2</sup>(19) (CA) **CANADIAN PATENT** (12)

(54) BOTTLE GRIPPER

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(21) APPLICATION No. 280,907

(22) FILED 770620

(30) PRIORITY DATE Japan (075469/1976) 760628

No. OF CLAIMS 19

REPRODUCED BY THE PATENT OFFICE, OTTAWA  
CMA-271 (5-93)

## A Bottle Gripper

ABSTRACT OF THE DISCLOSURE

A bottle gripper for handling a bottle when depositing powder paint on the bottle in a electrostatic powder coating process and the like, the gripper comprises  
5 a cylindrical arm in which a shaft is inserted coaxially in mutually movable manner along the axial direction, to the lower portion of the shaft several swingable pieces are attached being interlinked with the arm's lower end and lower portion of each pieces, which forms a short  
10 thin cylinder shell when gripping a bottle, is wrapped in a hat-shaped cover made of resilient material such as rubber and the outer rim of the resilient cover are fixed to the lower end of the said arm in order to protect against invasion of powder particles into the swing  
15 mechanism, the resilient cover is closed or opened by the mutual displacement between the arm and the shaft when gripping or degripping the head of a bottle.

This invention relates to a bottle gripper to be used to grip the head of a bottle when an electrostatic powder coating is applied to the bottle.

Also it is required to form a clear coating boundary at the upper end of the coated film formed on the bottle head so as to obtain a longer life of the film and maintenance of commercial value of the bottle.

To achieve the aforementioned requirements, some apparatus for avoiding the attachment of resin powder particles to the heads of bottles have been proposed with means



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of blowing or suctioning of gas or combinations of these. However in respects of security in long term operation and formation of a clear boundary, further development of new reliable means is urgently desired.

5 One object of the present invention is to solve the above problems and to furnish a gripper for bottles which makes it possible to completely avoid the attachment of resin to the bottle head while holding it firmly in the process of resin coating and to establish the formation of a clear boundary  
10 in the upper end of coating.

Another object of the present invention is to furnish a bottle gripper that is ensured against penetration of powder therewith.

A further object of the present invention is to furnish  
15 a bottle gripper that facilitates removal of resin particles from the gripper after electrostatic coating has been finished.

The present invention provides a device for holding a bottle during formation of a plastic coating on its exterior surface, said device comprising:

20 a hollow arm and an actuator element reciprocally movable therethrough, a cup-shaped cap of flexible material mounted on and depending from said arm, said cap having a depending annular flange surrounding a blind recess opening through the lower end of said cap,

25 a plurality of means extending into said flange pivotally secured to said actuator element for convergent and divergent movement as said actuator element is moved in opposite directions, the flange being adapted to seat over the end of a bottle and to clamp thereabout to seal it from deposit of dust-like particles  
30 when said means are caused to converge.



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Other features and objects of the invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawings in which:

5 Fig. 1 is a front view of a cross section of a bottle gripper of the present invention when its resilient cap is closed.

Fig. 2 is a cross section view taken along the line II-II in Fig. 1.

10 Fig. 3 is a front view of a cross section of the bottle gripper of the present invention when the resilient cap is opened.

Fig. 4 is a front view of a cross section of the resilient cap of the present invention.

15 Fig. 5 is a cross section view taken along the line V-V in Fig. 4.

Fig. 6 is a plan view of a swingable piece of the present invention.

20 Fig. 7 is a front view of a cross section of the swingable piece.

Fig. 8 is a side view of the swingable piece.

Fig. 9 is a front view of a cross section of a resilient cap of another embodiment.

25 Fig. 10 is a front view of a cross section of another embodiment of the present invention.



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Now reference is made to accompanying drawings.

In Fig. 1 and 2, numeral 1 designates a cylindrical arm in which a shaft 2 is inserted with a loose fit. At the lower portion of the cylindrical arm 1, the upper part of a supporter 3 is screwed with its lower end projecting inwardly. Further at the lower portion of the cylindrical arm 1, a resilient cap 4 is engaged and secured with screw by an outside holder ring 5. Also to the branch plates 6 of the lower portion of the shaft 2, the heads of plural swingable pieces 7 are attached with pins 8.

As seen in Fig. 4, 5 and 9, the resilient cap 4 is formed of an outer cylinder 9 and inner cylinder 10 extended integrally from the lower end of the outer cylinder 9 with a plurality of connections 19 between the upper end of inner cylinder 10 and outer cylinder 9 so that a gap 20 is formed between these cylinders. An upper flat wall 11 is formed at the upper end of the inner cylinders 10 and an annular ridge 12 is formed at the inner periphery of the lower end of the inner cylinder 10. Or as it is necessitated such ridge 12 is provided at the middle part of the inner wall of the cylinder 10.

As shown in Fig. 8 - 8, each swingable piece 7 has at its upper end pin holes 13 to receive said pin 8 and a projection 14 to be engaged with said supporter 3. The lower portion of the swingable piece 7 forms a skirt 15 dividing the circumference into four equal sections. However the skirt is not always required to be sized as



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just one fourth of the circumference. A groove 15 is formed to this skirt 15 to receive said connection 19 as necessitated.

Operation of this bottle gripper is as follows. In  
 5 Fig. 3, firstly the skirt 15 of the swingable piece 7 is inserted in the gap between the outer cylinder 9 and inner cylinder 10 of the cap 4. Then the upper portion of the cylindrical arm 1 is connected to a chain or conveyor (not shown) and advanced to one direction. As  
 10 the shaft 2 is pushed to the direction of arrow  $A_2$  by turning of a cam plate or screw (not shown), the projection 14 of the swingable piece 7 is supported by the supporter 3 and the swingable piece 7 is turned with the pin 8 as its center to the direction of arrow  $A_7$  to make  
 15 the lower portion of the resilient cap 4 wide open.

Now when the head of a bottle 17 enters in the inside of the resilient cap 4, the shaft 2 is pushed by cam plate in the direction reverse to arrow  $A_2$  as in  
 20 Fig. 1 whereby the projection 14 is disengaged from the supporter 3 or as the swingable pieces 7 are pressed by the supporter 3, the resilient cap 4 comes to grip the head of the bottle 17 with its spring action. In this  
 instance, the ridge portion 12 of the cap 4 engages the  
 25 portion just below a stripe rib 18 of the bottle head 17 to securely grip it whereby powder and any other matter can not enter into the inside of the gripper.

Under the state in Fig. 1, while the bottle 17 is securely gripped by the resilient cap 4, electrostatic



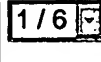
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coating of resin powder may be applied on the surface of the bottle 17. As described before, when the painting is over, the shaft 2 is pushed in the direction of arrow  $A_2$  to the state as in Fig. 3, thus there is formed a clear boundary line at the upper end of powder layer and the cap 4 can be removed from the bottle 17.

In the present invention, with upward or downward moving only of the shaft 2, the resilient cap 4 can easily grip the head of the bottle 17 very securely. Since the bottle head is covered by cap 4, no powder particles attach to the head of the bottle. Even when the bottle is not yet gripped by the gripper, no powder particles will deposit on the swingable pieces, as such swingable pieces 7 are completely enclosed by outer cylinder 9, inner cylinder 10 and upper flat wall 11. Therefore there will not occur any trouble caused by clogging of resin powder.

Another embodiment is illustrated in Fig. 10. Therein at the lower end of a cylindrical arm 1, a supporter 3 is integrally formed and at the outer periphery of the supporter 3, a resilient cap 4 is engagedly mounted. A cylinder 21 is rotatably attached to the lower end of a shaft 2. Branch plates 6 project downwardly from the cylinder 2 to which swingable pieces 7 are pivotally attached with pins 8. Projections 14 of the swingable pieces 7 are to be engaged in a recess 22 of the supporter 3. Other structures of this embodiment are the same with those in the embodiment in Fig. 1.





THE AMENDMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

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generally annular gap between a generally cylindrical inner wall and a generally cylindrical outer wall; and

a swingable piece pivotally coupled to the bottom portion of said arm, said swingable piece including skirt portion to be received in said annular gap and a projection to engage said supporter so that moving said shaft relative to said arm in a first direction causes said projection to engage said supporter and causes said skirt to pivot thus opening said resilient cap to receive a bottle and moving said shaft relative to said arm in a second direction opposite from said first direction, causes said skirt to pivot inwardly and said resilient cap to grip the bottle.

6. A bottle gripper as recited in claim 5 further comprising:

an upper wall extending across the top of said generally cylindrical inner wall thereby partially defining an opening for receiving the bottle and shielding said swingable piece from contamination such as a resin powder.

7. A bottle gripper as recited in claim 5 wherein said shaft includes branch plates extending from a lower portion of said shaft for pivotally coupling said swingable plate to said shaft.

8. A bottle gripper as recited in claim 7 wherein there are four branch plates and four swingable pieces arranged circumferentially around said shaft having generally equal spacing therebetween.

9. A bottle gripper as recited in claim 5 wherein said arm and said supporter are integral.

10. A bottle gripper as recited in claim 5 wherein said supporter is coupled to said arm by a screw engagement between said supporter and said arm.



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11. A bottle gripper as recited in claim 10 further comprising:

an outside holder ring for coupling said resilient cap to said arm, said holder ring supporting the outer cylindrical wall between said holder ring and said arm.

12. A bottle gripper for handling a bottle when depositing a powder paint on the bottle, said bottle gripper comprising:

a cylindrically shaped arm and a relatively movable shaft passing longitudinally and coaxially within said arm;

a supporter coupled by screw engagement to the bottom portion of said arm and having an inwardly extending portion;

a resilient cap having a generally annular gap between a generally cylindrical inner wall and a generally cylindrical outer wall, an upper wall extending across the top of said generally cylindrical inner wall thereby partially defining an opening for receiving the bottle, reinforcing members extending across said gap between said inner and outer walls, and an annular ridge for tightening said gap on the bottle extending inwardly from the lower end of the inner wall;

Four branch plates extending outwardly from said shaft, each of said branch plates having an opening for receiving a pivot pin;

four swingable pieces, one swingable piece pivotally coupled to each of said branch plates, each swingable piece including a skirt portion to be received in said annular gap and a projection to engage said supporter so that moving said shaft relative to said arm in a first direction causes said projection to engage said supporter and causes said skirt to pivot thus opening said resilient cap to receive the bottle and moving said shaft relative to said arm in a second direction, opposite from said first direction, causes said skirt to pivot



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inwardly and said resilient cap to grip the bottle; and  
 an outside holder ring for coupling said resilient cap to said arm, said holder ring supporting said outer cylindrical wall between said holder ring and said arm thereby protecting against the entry of powder particles into the pivotal coupling between said branch plates and swingable pieces.

13. A bottle gripper for handling a bottle when depositing a powder paint on the bottle, said bottle gripper comprising:

a cylindrically shaped arm and a relatively movable shaft passing longitudinally and coaxially within said arm, said arm including an integral supporter extending inwardly from the bottom portion of said arm and an outwardly facing circumferential groove;

a resilient cap having a generally annular gap between a generally cylindrical inner wall and a generally cylindrical outer wall, an upper wall extending across the top of said generally cylindrical inner wall thereby partially defining an opening for receiving the bottle, an annular ridge for tightening said cap on the bottle extending inwardly from the inner wall, and an annular protrusion extending inwardly from the inside surface of said outer wall to be received within said circumferential groove thereby securing said cap to said arm;

four branch plates extending outwardly from said shaft, each of said branch plates having an opening for receiving a pivot pin; and

four swingable pieces, one swingable piece pivotally coupled to each of said branch plates, each swingable piece including a skirt portion to be received in said annular gap and a projection to engage said supporter so that moving said shaft relative to said arm in a first direction causes said projection to engage said supporter and causes said skirt

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to pivot thus opening said resilient cap to receive the bottle and moving said shaft relative to said arm in a second direction, opposite from said first direction, causes said skirt to pivot inwardly and said resilient cap to grip the bottle.

14. A device for holding a bottle during formation of a plastic coating on its exterior surface, said device comprising:

a hollow arm and an actuator element reciprocally movable therethrough, a cup-shaped cap of flexible material mounted on and depending from said arm, said cap having a depending annular flange surrounding a blind recess opening through the lower end of said cap,

a plurality of means extending into said flange pivotally secured to said actuator element for convergent and divergent movement as said actuator element is moved in opposite directions, the flange being adapted to seat over the end of a bottle and to stamp thereabout to seal it from deposit of dust-like particles when said means are caused to converge.

15. The device described in claim 14 wherein the lower end of said flange has a radially inwardly directed bottle gripping ridge at the mouth of said blind recess.

16. The device described in claim 14 wherein said means are arranged in a circular pattern; a shoulder on each of said means engaging a fixed shoulder on said arm for causing said means to pivot when said actuator element is moved axially.

17. The device described in claim 14 wherein said flange has a plurality of blind pockets, one of said means seated in each of said pockets.

18. The device described in claim 17 wherein said means has a widened skirt portion at its lower end.

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19. The device described in claim 18 wherein the lower end of said skirt portion is intumed to form a bottle engaging and sealing ridge at the mouth of said blind recess in said cup.





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FIG. 1

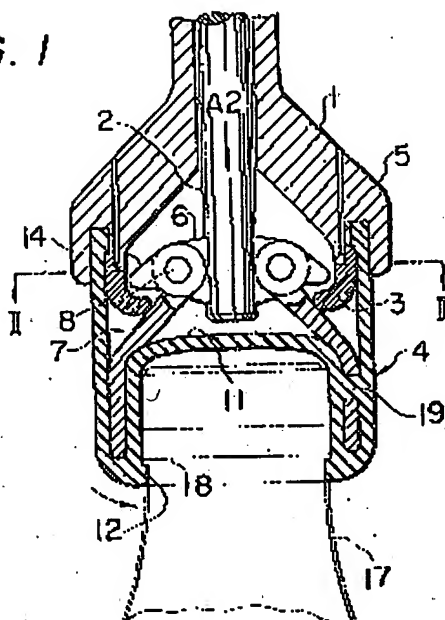
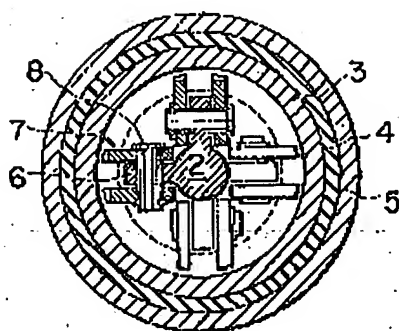


FIG. 2



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FIG. 3

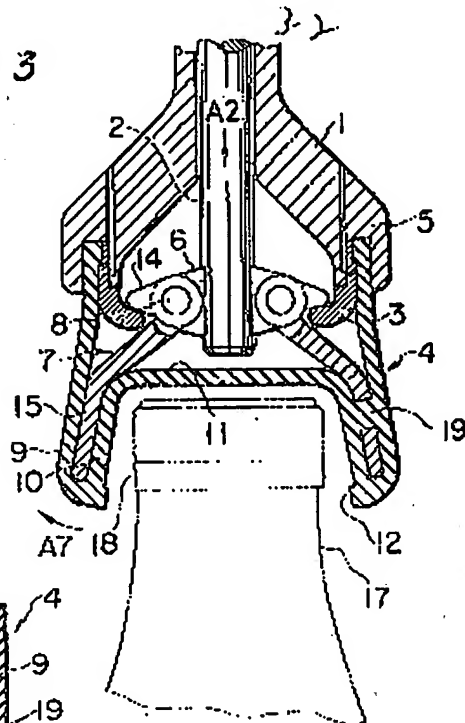


FIG. 4

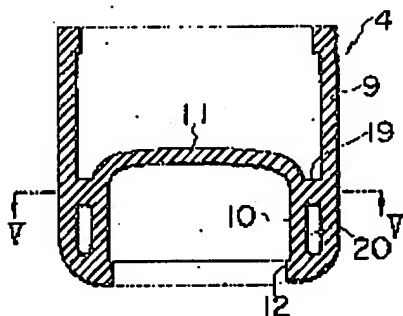


FIG. 6

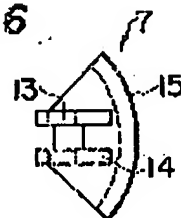


FIG. 5

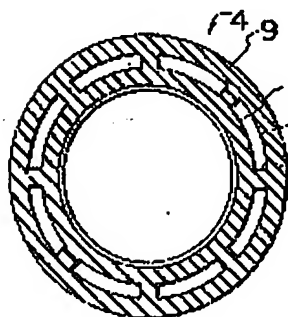
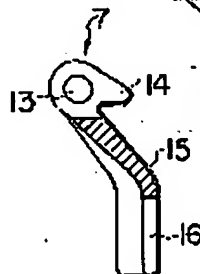


FIG. 7



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FIG. 8

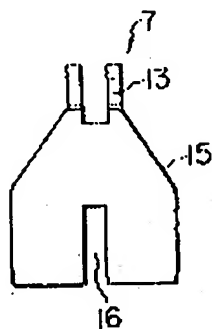


FIG. 9

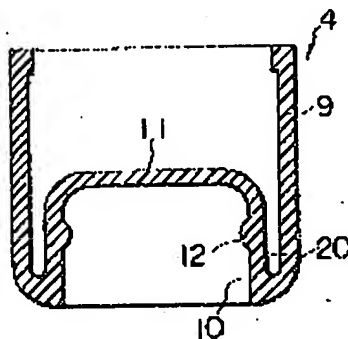
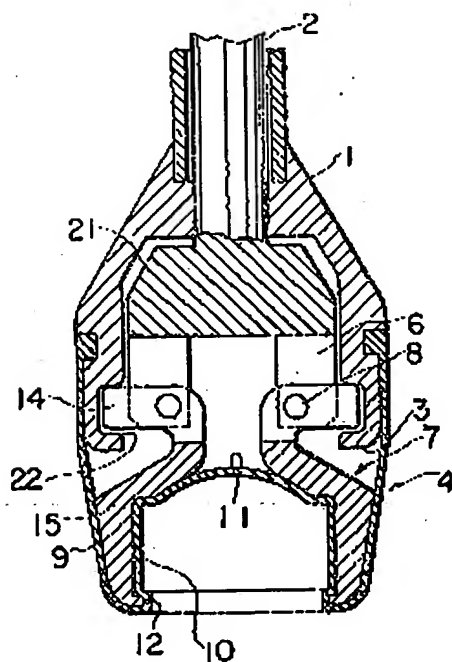


FIG. 10



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